
MindWave Mobile 2: User Guide

May 14, 2018

The NeuroSky® product families consist of hardware and software components for simple integration of this biosensor technology into consumer and industrial end-applications. All products are designed and manufactured to meet consumer thresholds for quality, pricing, and feature sets. NeuroSky sets itself apart by providing building block component solutions that offer friendly synergies with related and complementary technological solutions.

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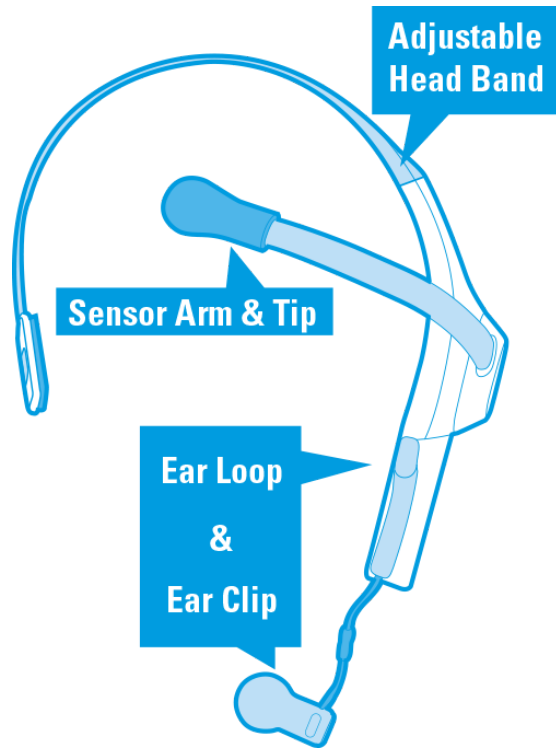
Introduction to the MindWave Mobile 2

Thank you for purchasing NeuroSky's MindWave™ Mobile 2. This innovative headset is designed for education and entertainment applications which turn your mental state changes and movements into actions, unlocking new worlds of interactivity. MindWave Mobile 2 reports the wearer's mental state in the form of NeuroSky's proprietary algorithms, including the Attention and Meditation eSense™ algorithms. The NeuroSky MindWave Mobile 2 can be used with supported video games, education software, and many other applications.

For any technical information updates and additional support questions not answered by this document please register at the NeuroSky support website at <http://support.neurosky.com>. We also recommend you join our email list by filling out the form on <http://www.neurosky.com> to receive general information about NeuroSky, new products announcements, and any technical information updates.

MindWave Mobile 2 Product Contents

- MindWave Mobile 2 headset
- MindWave Mobile 2 Quick Start Guide



Setting Up Your MindWave Mobile 2

Minimum System Requirements for Windows/Mac

| | Windows | Mac |
|-------------------------|------------------------------|-------------------------|
| Operating system | 7/8/8.1/10 | Mac OS X 10.8 or later |
| Processor | Intel Core Duo or equivalent | |
| Memory | 1GB or more | 1GB |
| Video | DirectX 9.0 or greater | Intel GMA900 or greater |
| Hard disk | 2.5GB free disk space | 2GB free disk space |
| Wireless | Bluetooth | Bluetooth |

Important: On 32-bit Windows 7 systems, the system must have at least Windows 7 Service Pack 1 (SP1) applied.

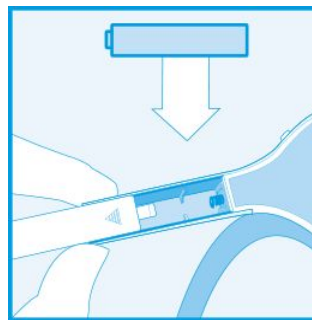
Minimum System Requirements for iOS/Android

| | iOS | Android |
|-------------------------|----------------------------|------------------------------------|
| Operating system | iOS 8.0 or later | Android 4 or later |
| Hardware | At least iPhone 5s, iPad 4 | Compatible Android phone or tablet |
| Wireless | BLE | Bluetooth |

Replacing The Battery

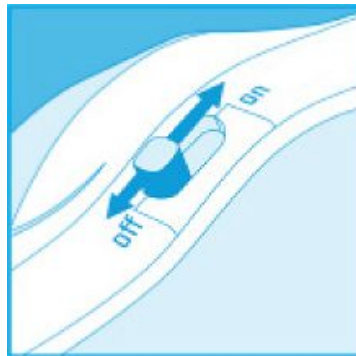
The MindWave Mobile 2 headset requires 1 AAA alkaline battery to operate, which provides 8 hours of run time. To install or replace the battery, slide open the battery cover. Remove any existing battery within and replace with a new alkaline AAA battery, making sure the polarity +/- are aligned correctly.

IMPORTANT: ONLY use alkaline batteries, or equivalent batteries that can sustain alkaline voltage levels under load. Please DO NOT use batteries labeled as “Zinc-Carbon” nor “Heavy Duty”, as their voltage levels quickly drop below usable levels during usage loads, which will result in inconsistent behavior, such as disconnects.



Power

To power on the MindWave Mobile 2 headset, slide the switch to the ON position. Then a blue LED light on the side of the headset will be turned on. If the MindWave Mobile 2 has a low battery, the LED light will appear red.



To turn the MindWave Mobile 2 off, slide the switch back to the OFF position.

LED Light

The device's LED light has two colors: red and blue. Refer to the chart to see what state the MindWave Mobile 2 is in.

| LED Light | MindWave Mobile 2 State | Meaning |
|------------|-------------------------|---|
| Off | Powered off | MindWave Mobile 2 is turned off or has no battery. |
| Solid blue | Powered on | MindWave Mobile 2 is turned on or connected |
| Solid red | Low battery | Need to replace the battery soon. IMPORTANT: Only use alkaline batteries. Do not use batteries labeled as "Zinc-Carbon" nor "Heavy Duty". |

Bluetooth Pairing

"Pairing" is when your computer/tablet/phone remembers your MindWave Mobile 2 headset, and your MindWave Mobile 2 headset allows that computer/tablet/phone to connect to it. Note that this is different from "connecting", which is when the computer/tablet/phone is actively sending or receiving data and information.

You must first pair each of your computers/tablets/phones to your MindWave Mobile 2 headset in order for them to connect to each other. To do so:

Turn on the headset, and make sure the Blue LED light is on. Then follow the instructions below for the device you want to pair to:

Important: There's no "pairing mode" on the MindWave Mobile 2 headset itself; the headset is ready to pair when turned on. Please DO NOT force the power switch to the edge. It will be damaged.

- For Windows/Android/Mac platform

Refer to the pairing procedure that came with your Windows, Mac or Android device. Select "MindWave Mobile" device when it appears on the device list. If you see multiple devices named MindWave Mobile, please select the one shown with a headset icon. Enter the "0000" as the Bluetooth authentication key if prompted. For full details about

how to pair with each platform, refer to the instructions in the MindWave Mobile 2 Quick Start Guide. You could get it from package or from this [link](#).

- For iOS platform

Visit mwm2.neurosky.com, and follow the on-screen guide to download, install and run the MindWave Mobile Tutorial app. Then follow the instruction in tutorial app to pair and configure the headset. No other explicit pairing is needed.

Note: Your MindWave Mobile 2 headset can "pair/remember" up to 3 devices (computers, tablets, or phones) at the same time. If you are using the MindWave Mobile 2 headset with more than 3 devices, you may need to remove the previous pairing from the device and re-pair it again.

Bluetooth Configuration

In order to function properly, the headset must know the electrical grid frequency of your country or territory. Please visit mwm2.neurosky.com, and follow the on-screen guide to download, install and run the "MindWave Mobile Tutorial" location in Tutorial Setting Page. If you travel to another country, please reconfigure the headset accordingly.

Bluetooth Connection

Depending on your computer/tablet/phone, it may automatically connect to the headset whenever an application needs to use the headset. If your Bluetooth software does not automatically connect when an app is started, please refer to the Bluetooth connecting instructions that came with your iOS, Android, Windows, or Mac device to manually connect to the headset before running your apps.

Serial/COM Port Name or Number

Some games and applications will ask for you to enter the serial COM port name or number for the game or application to connect to the headset. Use the Bluetooth software on your computer/tablet/phone to determine the COM port name or number that your MindWave Mobile 2 has been assigned to.

Wireless Connection Troubleshooting

| Problem | Problem | Solution |
|---|---|---|
| Unable to find or connect to MindWave Mobile 2 headset, or headset disconnects unexpectedly | Low battery | Replace the battery in the MindWave Mobile 2 with a new AAA alkaline battery. |
| | MindWave Mobile 2 is not turned on | Turn the MindWave Mobile 2 on. |
| | MindWave Mobile 2 is not paired to this computer. | Make sure that you use your computer/device's Bluetooth software to pair the headset. |
| | MindWave Mobile 2 headset is too far from the receiver device (e.g. your computer/phone/tablet) | Check that your headset stays within 10 feet of the receiver device. |
| | ThinkGear Connector is not running (only Windows and Mac). | Make sure the ThinkGear Connector (TGC) is running and enabled. |
| Other | Strong radio interference. | Move the headset closer to the Bluetooth on your computer/device. |

Note: If problems still persist, please visit <http://support.neurosky.com> or email support@neurosky.com.

Using Your MindWave Mobile 2

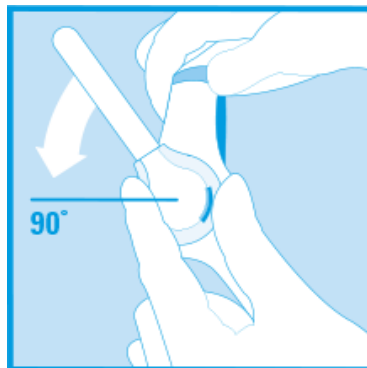
This chapter walks you through fitting the MindWave Mobile 2 and installation of the included MindWave Mobile 2 software on your computer. Be sure to first connect and pair the headset as described in the previous chapter first.

Fitting the MindWave Mobile 2

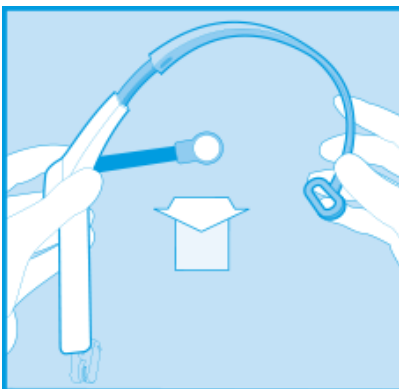
The MindWave Mobile 2 is more than your average headset. It has the ability to use your mental state for exciting new applications.

IMPORTANT: In order to take full advantage of these functions and features of the MindWave Mobile 2, you must first wear it properly.

1. Orient the MindWave Mobile 2 with the forehead Sensor Arm on your left hand side. Rotate the Sensor Arm from its base by about 90 degrees. It can be rotated slightly more if necessary to get proper fit and comfort.

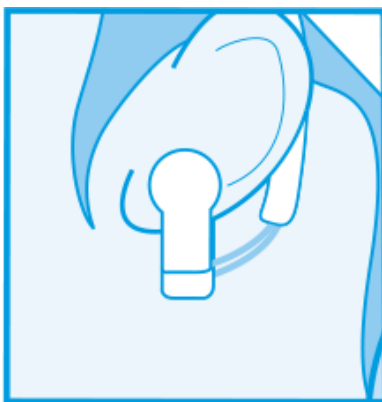


2. The overhead band of the MindWave Mobile 2 is adjustable and can be extended to fit various sizes. Put on the MindWave Mobile 2. If the sensor does not make contact with the forehead or if the fit is not comfortable, remove the MindWave Mobile 2 to re-adjust the overhead band and the forehead Sensor Arm. The forehead Sensor Arm is flexible and should arch inwards.

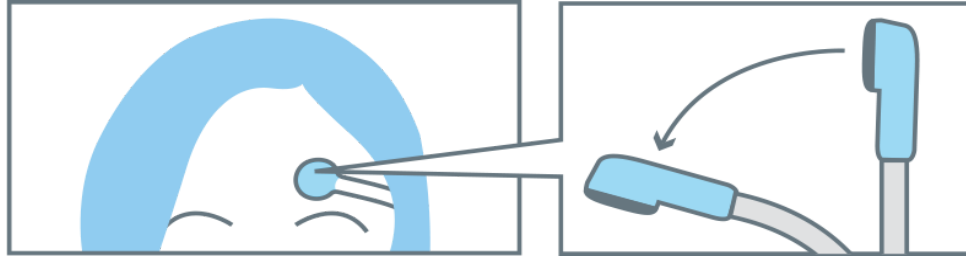


3. Allow the rubber ear hoop to rest behind your left ear, and then clip the earclip onto your earlobe.

4. **Make sure the two metal contacts on the inside of both sides of the earclip make skin-contact with your earlobe or ear.** Move any hair or obstructions (such as jewelry) out of the way. Readjust the earclip as necessary to make proper contact with the skin of your ear. You may need to squeeze the ear clip against your ear for a few seconds.



5. Adjust the forehead Sensor Arm of the headset so that the Sensor Tip makes contact with the skin of your forehead. This Sensor Tip must maintain steady skin contact in order to properly measure your mental state. The Sensor Tip should be comfortable, yet stay firmly in position, and never move around on your skin. Keep hair away from the sensor – **the sensor must be able to directly contact the skin at all times.** Make up, dead skin, or debris can interfere with the connection. Scratch or wipe the obstruction away if you have trouble obtaining a clean signal.



6. This is how the MindWave Mobile 2 should look when properly worn. During usage, if you are not receiving a signal, repeat the steps above to make minor adjustments to ensure the sensor and contacts have proper **skin contact**.



Note: If you are having problems with the signal quality, carefully re-check all the instructions above, and then try sitting still for a few seconds. Be aware that talking can sometimes interfere with the signal quality as well. If the above does not work, check that your head is not within a few feet of a strong electrical device (like a laptop adapter or an electrical outlet).

NeuroSky Technology Overview

ThinkGear

ThinkGear is the technology inside every NeuroSky product or partner product that enables a device to interface with the wearers' mental state. It includes the sensor that touches the forehead, the contact and reference points located in the ear clip, and the on-board chip that processes all of the signal received from the body surface. The eSense Meters (Attention and Meditation) are calculated on the ThinkGear chip.

eSense

eSense(tm) is a NeuroSky's proprietary algorithm for characterizing mental states. To calculate eSense, the NeuroSky ThinkGear technology amplifies the biosignal and removes the ambient noise and muscle movement. The eSense algorithm is then applied to the remaining signal, resulting in the interpreted eSense meter values. Please note that eSense meter values do not describe an exact number, but instead describe ranges of activity.

eSense Meter - General Information

The eSense meters are a way to show how effectively the user is engaging Attention (similar to concentration) or Meditation (similar to relaxation).

Like exercising an unfamiliar muscle, it may take some time to gain full proficiency with each of the eSense™ meters. In many cases, people tend to be better at one eSense than the other when they first begin. We recommend trying different tactics until you are successful with one. Once you see a reaction on the screen from your efforts, you will be able to duplicate the action more easily with additional practice.

Generally, Attention can be controlled through a visual focus. Focus on a singular idea. Try to “funnel” your concentration and focus your train of thought towards pushing up the meter. Other suggestions include picking a point on the screen to stare at or imagining the action you are trying to accomplish happening. For example, look at the Attention eSense meter and imagine the dial moving towards higher numbers.

For Meditation, it typically helps to try to relax yourself. Connect to a sense of peace and calm by clearing your mind of thoughts and distractions. If you are having difficulty engaging Meditation, close your eyes, wait a number of seconds, and then open your eyes to see how the meter has responded.

If you have trouble at first in controlling your eSense meter levels, be patient. Try different techniques and practice. Also be sure to read and try to understand the Technical Description in order to get a better idea about how eSense actually works under the hood.

eSense Meter - Technical Description

For each different type of eSense (i.e. Attention, Meditation), the meter value is reported on a relative eSense scale of 1 to 100. On this scale, a value between 40 to 60 at any given moment in time is considered “neutral”.

A value from 60 to 80 is considered “slightly elevated”, and may be interpreted as levels tending to be higher than normal (levels of Attention or Meditation that may be higher than normal for a given person). Values from 80 to 100 are considered “elevated”, meaning they are strongly indicative of heightened levels of that eSense.

Similarly, on the other end of the scale, a value between 20 to 40 indicates “reduced” levels of the eSense, while a value between 1 to 20 indicates “strongly lowered” levels of the eSense. These levels may indicate states of distraction, agitation, or abnormality, according to the opposite of each eSense.

The reason for the somewhat wide ranges for each interpretation is that some parts of the eSense algorithm are dynamically learning and at times employ some “slow-adaptive” algorithms to adjust to natural fluctuations and trends of each user, accounting for and compensating for the fact that the human mental change are subject to normal ranges of variance and fluctuation. This is part of the reason why ThinkGear sensors are able to operate on a wide range of individuals under an extremely wide range of personal and environmental conditions, while still giving good accuracy and reliability.

ATTENTION eSense

The eSense Attention meter indicates the intensity of a user's level of mental “focus” or “attention”, such as that which occurs during intense concentration and directed (but stable) mental activity. Its value ranges from 0 to 100. Distractions, wandering thoughts, lack of focus, or anxiety may lower the Attention meter level.

MEDITATION eSense

The eSense Meditation meter indicates the level of a user's mental “calmness” or “relaxation”. Its value ranges from 0 to 100. Note that Meditation is a measure of a person's mental states, not physical levels, so simply relaxing all the muscles of the body may not immediately result in a heightened Meditation level. However, for most people in

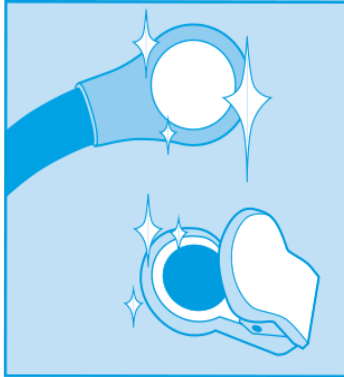
most normal circumstances, relaxing the body often helps the mind to relax as well. Meditation is related to reduced activity by the active mental processes in the brain. It has long been an observed effect that closing one's eyes turns off the mental activities which process images from the eyes. So closing the eyes is often an effective method for increasing the Meditation meter level. Distractions, wandering thoughts, anxiety, agitation, and sensory stimuli may lower the Meditation meter levels.

Additional Products

To find new and exciting ways to unlock the full potential of you MindWave Mobile 2, visit the NeuroSky Store for additional software and applications: <http://store.neurosky.com>

Maintenance

- Clean the sensor and ear contacts with alcohol or a damp cloth periodically to ensure the best signal quality. Use a soft cloth to clean the MindWave Mobile 2 casing.



- For travel and storage, gently push the sensor arm up until it is aligned with the top of the headset. Be careful not to overextend the maximum range of the boom by adjusting it beyond the natural stopping point.
- Do not expose the MindWave Mobile 2 to temperatures above 140°F (60°C)
- Dropping or throwing the MindWave Mobile 2 may cause damage to the MindWave Mobile 2.
- Remove the battery from the MindWave Mobile 2 when not in use for extended periods of time.



Troubleshooting and Support

The MindWave Mobile 2 does not turn on.

The battery might be low. Please try replacing the battery and try again.

The signal quality status is consistently poor.

Check that the forehead sensor and each clip contacts are making good contact with the skin. Make sure to remove all obstructions including hair and jewelry.

It usually takes three or four seconds for the headset to validate the signal after holding still. Also make certain to keep the sensor and contacts clean.

The eSense meters do not move.

Be sure to allow several moments for the eSense meters to go through some self-calibration and initialization before troubleshooting. If the meters still do not move after 10 seconds, make sure the sensor rests on the skin of the forehead and the contacts are on the skin of the left ear. The sensor and contacts must always make firm and consistent contact with your skin.

I don't seem to be able to control the eSense(tm) meters.

Like exercising an unfamiliar muscle, it may take some time to gain full proficiency with the eSense™ meters. First, be sure you understand how the eSense meters work and what they are measuring. Generally, we recommend engaging Attention by concentrating and Meditation by relaxing. Most importantly, be sure you have read the detailed explanation of eSense previously described in the [eSense](#) sections.

I still have a problem, or my problem is not covered by this Troubleshooting section.

For further technical support, please contact NeuroSky Support at <http://support.neurosky.com> or email support@neurosky.com.

Safety and Regulations

Operating Conditions

- Operating temperature: 0-35C
- Headset: 1.5V / 95mA maximum average current

Safety

- Batteries should not be exposed to excessive heat such as sunshine, fire, or similar conditions.

ISO/IEC

ISO/IEC Guide 37 [17].

- No naked flame sources, such as lighted candles, should be placed on the apparatus;
- Battery disposal: This product requires the use of an AAA battery. AAA batteries commonly available in the market contains hazardous waste and should be properly disposed of. Contact your local government for disposal or recycling practices in your area.

FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.